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We are indebed to a friend for the following clear and satisfactory explanation of the recent rupture of the boiler of the steamer Mohegan. It will be seen that the fault was not in the form, but in the construction of the boiler. Such accidents serve as useful lessons to the careful mechanic—by teaching the necessity of increasing the strength of the boiler in those portions which have hitherto been left comparatively weak.

EXPLOSION OF THE BOILER OF THE STEAMBOAT MOHEGAN.—APRIL, 1843.

The steamboat Mohegan, at the time of this explosion, was furnished with two copper multiflue or tubular boilers, two and a half years old, constructed after the plan of locomotive engine boilers, for railroads. The tubes, (260, or thereabouts, in number,) had a length of about eleven feet, with a diameter of about two and a half inches. One only, of the boilers burst. The rupture was in the flank of the outer cylinder or shell, partially underneath and nearly midway of the length of the tubes. It evidently commenced at an arm-hole, three by seven inches, in the side of the boiler. From this arm-hole a rent was made each way to the nearest seam or row of rivets, the portion separated hanging like a flap, of the width of a single sheet of copper, and forming an opening for the escape of hot water and steam, of about three square feet. The explosion was accompanied by a loud report, and the end of the boiler nearest the rupture, was raised some three feet from its bed. The circumstances attending this explosion do not appear to warrant the conclusion of its having been produced either by a deficiency in the supply of water, or from an undue pressure of the steam. The part which gave way, was low down in the boiler, and was not exposed either to the direct or indirect action of the heat, and could not therefore have been weakened from this cause, and had there been an extraordinary pressure of steam, the boiler, if properly constructed, would have yielded internally, as in all similar cases of locomotive boilers, by the rupture of one or more of the tubes, and the effect would also most likely have extended to the boiler, between which and the ruptured one there was a free communication.

The cause, therefore, for the bursting of the boiler was in all probability,

the want of a due degree of strength in the boiler itself, at the place of rupture. It is possible that this defect may have been in the copper. The sheet which gave way might have contained, perhaps, some flaw not discovered by the manufacturer. Supposing the material to be sound in all respects, still there were, in our view, mechanical defects in the structure of the boiler itself.

1st. The edge of the arm-hole was not protected from rupture by a band soldered and riveted thereto.

2d. The boiler rivets were too large, or too near together, by which, too much of the metal or substance of the copper was cut away.

3d. There were no stay-bars or bolts to support the sides or shell of the boiler, and no bands enclosing it.

This last circumstance is, we think, very conclusive as to the want of the requisite strength in the boiler. For the distance of eleven feet, the length of the tubes, no stay-bolts were inserted. The diameter of the shell of the boiler of this portion, is about eight feet. Its form cylindrical. With so great a diameter and length, the effect of the pressure of the steam acting with all the advantage of the funicular power in forcing out the sides of the boiler, it was scarcely possible that the copper should long be able to stand.

The locomotive boilers used upon railways are unquestionably the safest form of boilers, and for the very good reason that the shell is so much stronger than the tubes, that the latter under an undue pressure are always the first to yield, and as they are of small size the rupture of one or more is not attended with serious consequences. Each tube becomes in fact, a safety valve and the steam finds vent in a mode not likely to produce serious injury. The boiler of the Mohegan had less relative strength than a locomotive boiler, inasmuch as it was constructed of copper instead of iron, and of much greater magnitude. It is true that the former was designed to be worked with a less pressure of steam, but the difference in this respect was less than the difference in the absolute strength of the two descriptions of boilers.

A most important consideration in the construction of the tubular or multiflue boiler, is the giving to the exterior cylinder or shell a greater degree of strength than is possessed by the tubes. There is no difficulty in accomplishing this, even with boilers as large as those of the Mohegan. When so constructed, they are the safest form of boiler, and as they are not surpassed for effectiveness in generating steam, we hope that the case of the Mohegan will not be quoted to their prejudice, but serve rather to induce a more full investigation and thorough appreciation of their merits.

FULTON.

REPAIRS OF RAILWAYS.

All the first attempts at railways in the United States, as their defects of construction were developed in working them, were over and above that expense, put to heavy annual expenditures in correcting those defects, which

belonging more properly to construction, should have been charged to the capital in the road; but the whole appearing in *one item* under the head of ordinary repairs, has led to very exaggerated impressions as to the costliness of merely maintaining a railway, and which are yet indiscriminately entertained of the old and more modern structures, without considering that in the latter most of those original defects have been corrected, and that principally by a more liberal outlay in their first construction.

A case particularly illustrating this fact, is found in the Baltimore and Ohio railroad, among the earliest of these enterprizes, which after contending for several years with every difficulty, was nigh being abandoned in despair, and was only saved by Mr. M'Lane being called to preside over it in 1837, at which period he describes its condition in the following terms.

"The main stem to Harper's Ferry was in a state of utter delapidation, the moving power and machinery inadequate to the accommodation of the business actually offered for transportation. The department of repairs of the road was both expensive and inadequate, consisting of an unnecessary amount of superintendance without the requisite skill, and under large outlays, the road was annually becoming worse. All the repairs of machinery were made by others, under contracts at high prices, and so inadequately performed, that every part of the machinery was daily becoming more unfit for use. Public confidence appeared to be entirely withdrawn."

It is from its operations under this condition of things that most of the arguments have been drawn, and are to this day appealed to against the railway system in general. The report shows that from 1837 to 1842 the average annual expenditure in remodelling the road, was for those five years, $83,400, or $850 per mile, being $370 for labor, and $480 per mile for materials; and that now, although laboring under many miles of flat bar road, the expense for labor of adjustment and repairs of road, is reduced to $650 per mile per annum. Instead, therefore, of the above dark picture of 1837, we have now its condition in 1842, described by Mr. M'Lane in the following bright colors; and considering the disadvantages still, of this machine, in *heavy grades*, *short curves* and *flat rail*, its present success may be appealed to, as the *complete triumph* of the modern railway system in judicious hands and in suitable locations.

"Here is now a system of railroad operations reduced to a scale of greater cheapness and economy than any other known to us in Europe or the United States, and brought to its present perfection by nearly five years of arduous toil and the exercise of all the skill and science the company could employ. It is daily complying with all the demands of trade, and giving universal satisfaction to the public, with fewer interruptions, and at less cost of transportation, than any other known road."

The reports from several roads for a series of years, furnish the following rates per mile per annum, for adjustment and repair of road, but as no details are given, it is not known what proportion belongs to repairs and what to re-construction, and the average being struck on merely the distance be-

tween the two termini of the road, without counting the miles of sidings or double track, they cannot be fully relied upon as showing the *true amount of ordinary cost* of maintenance of road.

Boston and Lowell,	26 miles,	edge rail,	average pr. mile for	5 years,	$681
Boston & Providence,	41 "	"	"	5 "	367
Boston and Worcester,	45 "	"	"	5 "	501
Utica and Schenectady,	78 "	flat bar,	"	5 "	450
Georgia railroad,	100 "	"	"	5 "	240
Baltimore and Philad.	95 "	mixed rail,	"	3 "	500
Philad. and Reading,	56 "	edge rail,	"	2 "	300

The varying circumstances of the above roads, as to character of structure, soil, facility of drainage, prices of labor and materials, renders an average of them entirely futile, and shows the necessity of judging each road separately by its own merits and peculiarities.

To come, then, more strictly to the item of repairs and labor of adjusting track, let us look into the different constructions of road and show what is the whole cost of materials composing them; the entire consumption of these, *in a given time*, being of course the limit of the cost of these repairs, which fluctuating as to amount in the annual intervals, will result in the following average per mile for the whole period.

No. 1.

Ground sills 21,100 feet N. Car. pine per mile,			274			
Joint pieces	5,000 feet	do.	65			
Sleepers	1,760	7 by 8 inch,	493—832	last 5 years,	loss per mile per annum,	166
Bridges, wooden portion, average cost per mile,			1,500	" 12 "	"	125
Iron rail, chairs and spikes,			4,000	" 25 "	wear 25 per cent per ann., or per mile,	40
						331
Labor of adjusting track and making repairs, per mile,						269—$600

No. 2.

Ground sills,		per mile,	253			
Cross ties and joint pieces,			271			
Longitudinal string pieces, yellow pine,			316—840	last 5 years,	loss per mile per annum,	140
Bridges, wooden portion, average cost per mile,			2,500	" 12 "	"	208
Iron rail, chairs and spikes,			4,000	" 25 "	wear 25 per cent per ann., or per mile,	40
						388
Labor of adjusting track and making repairs per mile,						312—$700

No. 3.

Oak sleepers on broken stone beds 1,700 pr. m.,			510	last 7 years.,	loss pr. mile. pr. an.	73
Bridges, wooden portion, average per mile,			2,500—3,010	12 "	"	208
Iron rail, chairs and spikes,			4,000	25 "	wear 25 per cent per ann., or per mile,	40
						321
Labor of adjusting track and making repairs, per mile,						250—$500

In the above, we have the true principle by which to estimate the labor and repairs of a railway, the amount of which, will be governed, and vary according to the location and other peculiarities of each road.

The periods assigned above, as the duration of each item are about the averages determined by past experience. The nature and seasoned character of the woodwork, but more particularly the variableness of soil to be expected on a long line, all more or less affect its durability. In certain soils

the oak timber will be destroyed in 4 to 5 years, and in others, last 10 to 12 years, the average about 7 years. Pine wood on the ground decays in 5 to 6 years. Locust and cedar the most durable, are too costly to be commonly used. The *frame timbers* of the bridges first well seasoned and then painted, should last 20 years, the flooring being the portion most exposed to decay, and an average of 12 years duration for the whole, is not an over estimate. The *rolled iron rail* it is now well ascertained, after 15 years experience, when of *originally good mineral and well manufactured* that its renewal *costs little more* than the labor of replacement, at which rate its entire cost could not be expended under 25 to 30 years, and where with two tracks, it is used only in one direction, it may be said to be everlasting, under almost *any amount of business.*

The exemption from bridges on a railway is a great saving, first and last, but is rarely found at less than the amount in our estimate. The long Island railroad is, however, *peculiar*, in being without a single bridge, and on a straight line, for 100 miles. The amount of business on a railway will affect only in a small degree the expenditures for adjustment and repairs, the nature of this machine being, on the score of safety in particular, to exact as *good order* for a small, as for a large business, and once in order, it answers with but a trifling addition of expense as well for the passage over it of a dozen as of only one daily train; hence is its full economy only found under a large business, and the fact made more manifest, that it is the cheapest means of transport, in all cases, for passengers and light freight; and under favorable circumstances for all kinds of heavy freight, carried at a speed of about 10 miles per hour.

Thus has the railway structure been gradually and *imperceptibly* acquiring strength and completeness in all its parts; and in none more than in its mainspriug, the locomotive, which is now made with a *vast increase* of power and efficiency, and with scarcely and more pressure on any single point of the road, than the cars it drags; so that as compared with its condition 10 years back, the *entire railway machine* is improved *one hundred fold;* and although the old data has thus been rendered obsolete, it is still commonly adduced against the railway system by the interested and uninformed, either entirely to condemn, or at least to show it up unfavorably in the comparison with canals.

The following cost of working English railways is taken from Professor Vignoles' lectures, and is useful as showing that our American railways are worked quite as economically.

	Per mile per train.	Lowest rate, cents.	Medium rate, cents.
Locomotive power,	"	25	32
Repairs of carriages,	"	6	8
Maintenance and repairs of road,	"	14	16
Conducting traffic and stations,	"	10	10
Rates, taxes, and government duty on passenger,	"	14	16
Police,	"	3	4
Management,	"	5	6
Miscellaneous expenses,	"	3	4
		80	80

This cost includes every thing save interest on loans and dividend on capital.

MAIN LINES OF RAILWAY FOR 1842.

The general impression is, that all our railways are actually sinking money, but this is not true of the principal main lines in various sections of our country, and still less so of many of the minor ones, which on the contrary are very profitable. The reports of the main lines for 1842, show an average yield of 5 per cent. on their entire cost in capital and loans, which for a period of such unparalleled stagnation, is doing very well; and as to their *indirect dividends* or saving to the public, (of which, however, it takes no note,) in transportation of person, merchandize and intelligence, it cannot be counted. Let us enumerate a few examples in round numbers.

	Name of road.		Miles.	Cost.	Nett rect.'42.	Pr.ct.
1	Philadelphia and Columbia,	edge rail,	82	$5,000,000	$200,000	4
2	Philadelphia and New York,	do.	87	7,000,000	400,000	5¾
3	Boston and Albany, (first year)	do.	200	9,600,000	385,000	4
4	Phila. and Baltimore,	mixed rail,	94	6,000,000	230,000	4
5	Balt. and Ohio, to H. Ferry,	do.	100	5,000,000	210,000	4¼
6	Albany to Buffalo,	flat rail,	322	7,000,000	640,000	9
7	Augusta to Madison, Ga.,	do.	147	2,400,000	135,000	5½
			1032	$42,000,000	$2,200,000	

In the above costs, are included all the extraneous burthens with which many of these roads are saddled, and against which nothing could sustain them but an extraordinary elasticity peculiar to this improvement, for which it has generally no credit. In the instances where the stock has been temporarily annihilated, as with the *Baltimore and Philadelphia*, by the necessity of the immediate return of the loans, the railway, as a fair money making concern in proper locations, should not be held responsible. These drawbacks are not the fault of the system but its misfortune, and will serve as warning beacons in all future projects of this kind.

ANNUAL REPORT OF THE COMMISSIONERS OF THE CANAL FUND, FOR 1842.

We have seldom seen so much useful information condensed into a small compass, as we find in this document. Unlike most productions of the kind, it is clearly and methodically arranged, giving the result of great research in such a comprehensive form, that every reader may verify for himself the important conclusions drawn by the commissioners. Where all is so concise it would be useless to endeavor to form an abstract; we shall therefore content ourselves with giving such of the tables and statements as are of most general interest.

"The amount of toll received on each canal during the season of navigation in 1842, is as follows:

Erie canal,	$1,568,946 56
Champlain canal,	95,957 54
Oswego "	31,222 19
Cayuga and Seneca canal,	16,948 16
Chemung canal,	7,702 05
Crooked lake canal,	989 39
Chenango "	13,615 38
Genesee Valley "	13,204 11
Oneida lake "	462 63
Seneca river towing path,	149 51
	$1,749,197 52

"There is a diminution in the tolls compared with the year 1841 of $285,685. Of this diminution, $130,921, or 45 83-100 per cent, is on descending, and 154,754, or 54 17-100 per cent is on ascending freight.

The total tons of all descriptions of property which moved on the canals is shown to be 1,236,931, and the total value of the same property $60,016,608."

The most valuable part of this report is to be found in a series of comparative tables from which we shall make several extracts:

The total tonnage of all the property transported on the canals, ascending and descending, its value, and the amount of the tolls collected for the six years preceding, is as follows, viz:

Year.	Tons.	Value.	Tolls.
1836,	1,310,807	$67,634,343	$1,614,342 46
1837,	1,171,296	55,809,288	1,292,623 38
1838,	1,333,011	65,746,559	1,590,911 07
1839,	1,435,713	73,399,764	1,616,382 02
1840,	1,416,046	66,303,892	1,775,747 57
1841,	1,521,661	92,202,929	2,034,882 82
1842,	1,236,931	60,016,608	1,749,196 00

The total tons coming to tide water, for each of the last nine years, and the aggregate value thereof in market, were as follows, viz:

Year.	Tons.	Value.
1834,	553,596	$13,405,022 00
1835,	753,191	20,525,446 00
1836,	696,347	26,932,470 00
1837,	611,781	21,822,354 00
1838,	640,481	23,038,510 00
1839,	602,128	20,163,199 00
1840,	669,012	23,213,573 00
1841,	774,334	27,225,322 00
1842,	666,626	22,751,013 00

The quantity of wheat and flour that came to the Hudson river rapidly rose to a maximum in 1840, since which year there has been a decrease.

The tonnage from tide water in 1842 was 123,294, the larger portion of which was merchandize.

"There is a decrease of merchandize going up the canals of 38,628 tons, and a decrease in the quantity of other articles of 793 tons, making a total decrease in the ascending tons, comparing 1841 with 1842, of 39,421 tons.

The tons coming to tide water have decreased 107,708, comparing the present with the preceding year."

Of the merchandize cleared at Albany, West Troy, and Schenectady, (94,212 tons)—about 60 per cent was left at the Erie canal, 11 per cent on the Champlain canal, 10 per cent on the Oswego canal, 7 per cent on the Cayuga and Seneca canal, and the rest on the other canals, from 1 to 3 per cent each.

WESTERN TRADE.

The products of other States coming by way of Buffalo, have rapidly increased in amount—being in 1842, 179,437 tons, nearly the same as for

1841—of these the agricultural products and miscellaneous articles have constantly increased, while the products of the forest and manufactures have slightly decreased since 1841.

The same proportion holds in regard to the tonnage from other States by way of Oswego—the amount however being but 9,217 for the last year.

STATE OF TONNAGE AND BUSINESS OF THE CANALS.

"The tonnage of the canals, whether in boats or rafts, having reference to its source, naturally falls under the following five general heads of clasification:

1st. The products of the forest; 2d. Agriculture; 3d. Manufactures; 4th. Merchandize; 5th. Other articles.

It is in reference to this division of the commerce of the canals, that the following statements have been made out.

The commissioners have thought it not without interest to institute a comparison for a series of years of the tons, value and tolls of each head of transportation above given, in view of ascertaining the increase or diminution of the tons, value or tolls of the total movement. To this end, sundry statements have been compiled from the reports, corresponding to this, which have annually been made to the legislature for a series of years."

The tons classified as above of the *total movement* on all the canals from 1836 to 1842, is as follows:

Year.	Products of the forest.	Agriculture.	Manufactures.	Merchandize.	Other articles.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1836,	755,252	225,747	88,810	127,895	113,103	1,310,807
1837,	618,741	208,043	81,735	94,777	168,000	1,171,296
1838,	665,089	255,227	101,526	124,290	186,879	1,333,011
1839,	667,581	266,052	111,968	132,286	257,826	1,435,713
1840,	587,647	393,780	100,367	112,021	222,231	1,416,046
1841,	645,548	391,905	127,896	141,054	215,258	1,521,661
1842,	504,597	401,276	98,968	101,446	130,644	1,236,931
Total 7 years,	4,444,455	2,142,030	711,270	833,769	1,293,941	9,425,465
Yearly av. 7 ys.	634,922	306,004	101,610	119,109	184,848	1,346,495
Pr.ct. each class,	47·15	22·72	7·55	8·85	13·73	100
An. av. 1836 to 1839, 4 years,	676,666	238,767	96,010	119,812	181,452	1,312,707
An. av. 1840 to 1842, 3 years,	597,264	395,654	109,077	118,174	189,377	1,391,546

Under the head of other articles are found chiefly stone, lime and clay—the larger part of which were for the constructions on the canal, as the decrease during the past year will indicate—beside these, gypsum and coal make up nearly the whole amount. The quantity of coal appears to be steadily increasing. From this table it will be seen that the annual average of the total *movement* obtained by comparing the last three with the preceding three years, increases two per cent per annum. This increase is the result of the increase of Agriculture, Manufactures and Sundries, over the decrease of the products of the Forest and Merchandize.

The tolls paid on the "total movement" of articles, and upon boats and

passengers, annually from 1837 to 1842, both years inclusive, are as follows:

Year.	Boats and passengers.	Products of the forest.	Agriculture.	Manufactures.	Merchandize.	Other articles.	Total.
	Dollars.	*Dollars.*	*Dollars.*	*Dolls.*	*Dollars.*	*Dolls.*	*Dollars.*
1837,	195,508	211,118	370,041	75,507	380,826	56,430	1,289,430
1838,	210,457	229,998	468,495	74,941	526,911	78,555	1,589,357
1839,	181,323	253,710	479,534	81,251	535,486	83,662	1,614,966
1840,	185,022	197,904	806,623	76,765	427,966	80,467	1,775,747
1841,	179,819	313,444	785,943	95,596	558,003	102,078	2,034,882
1842,	165,515	211,979	805,376	70,611	393,875	101,840	1,749,196
Total for 6 years,	1,117,644	1,418,513	3,718,012	473,670	2,823,067	503,032	10,053,578
Yearly average,	186,274	236,359	619,669	78,945	470,511	83,838	1,675,596
Per cent.,	11·12	14·11	36·98	4·71	28·08	5·00	100
Average from 1837 to 1839 both inclusive,	195,763	231,609	439,356	77,233	481,074	72,882	1,497,917
Average from 1840 to 1842 both inclusive,	176,785	241,109	799,981	80,657	459,948	94,795	1,853,275

Comparing the tolls for the same two periods of three years each—it will be found that the decrease is only on boats, passengers, and merchandize.

"Thus it appears that, comparing the last three with the previous three years, while the average annual increase of the tolls is 7 per cent, the average annual increase of the total movement of tonnage, or of the matter which fills up the canals, is only 2 per cent. The reason for this is found in the fact that the forest, which for the last seven years has furnished 47 per cent of the tonnage, has contributed about 14 per cent of the tolls, and that agriculture, which has furnished but about 22 per cent of the tonnage, contributes now nearly 50 per cent of the tolls, and that while the tonnage of the

forest decreases 2, that of agriculture increases 3. The reason for the small increase in the *tolls* on the products of the forest, while there is a decrease in the *tons*, may be that a less number of tons was transported a greater number of miles, the natural consequence of a supply which must continue in every locality to be in an inverse ratio to the demand. The diminution of about $20,000 in the tolls on "boats and passengers," is mainly, if not wholly on passengers alone, the toll on the passengers having been reduced in 1841 from two mills per mile to one mill per mile on each person carried on board of packet or freight boats."

From a table giving the tonnage of each class of articles coming to the Hudson river, the following information is derived.

"Of this tonnage, the forest furnishes about 60 and agriculture about 31½ per cent., in all about 91½ per cent; that the forest decreases and agriculture increases in nearly the same proportion, keeping the tonnage just about stationary, the annual average of the last four years, being 675,449 tons, and the annual average of the last eight years being but 676,736 tons."

The course of the tonnage between Utica and Albany is shown by the lockages at Alexander's lock—the first west of Schenectady. The increase of the annual average of these for the four last over the four preceding years is 1,519, equal to a gain of 1 53-100 per cent. per annum.

Estimating the business of this, the main thoroughfare of the Erie canal, by the boats clearing from and arriving at Albany and Troy, it is found that the annual average for the last five years is 956 less than for the five preceding, being a decrease of 59-100 of one per cent per annum for the last five years. Notwithstanding this decrease it is stated that a large portion of the lockages in 1829, 1840, 1841, were consequent upon the enlargement of the canal, being for stone and other materials for the works between Utica and Schenectady.

"One ton of the products of agriculture pay more than four times as much toll as one ton of the products of the forest. The tons of the products of the forest which came to tide water in 1842, were 321,480, or about one-half the tonnage which came to tide water. If hereafter none of the products of the forest should reach tide water, and its place should be supplied by only 80,000 tons of the products of agriculture, the canal might lose nothing in tolls, and would get rid of 240,000 tons, or more than one-third of the tonnage arriving at tide water. Thus it will be seen that the tonnage may very sensibly diminish and the tolls may, at the same time, and at the present rates, increase."

From the internal demand of the State for bread stuffs, it is estimated that the surplus arriving at tide water, of the *growth of this State*, will little if any exceed that of past years.

"Thus it is comparing 1836 with 1842, that while the increased delivery at tide water of flour and wheat, is about 75,000 tons, the increase from western States is about 100,000 tons. It will be seen also that the products of this State, and the delivery at tide water in 1840, exceed that of either of the two subsequent years, while the product of western States steadily increases."

The results of a table of lockages at seven different points, confirm the evidence before given.

"At every point west of Utica, the lockages seem to have been less in the last year, than in 1835 or 1836.

It is seen that at Alexander's lock, three miles west of Schenectady, the lockages in 1841 were over 30,000 with a single lock, while at Black Rock and at Lockport, they were less than 12,000 last year, and at the Syracuse lock, (east of Syracuse, and taking the tonnage from the Oswego canal,) 19,397, and at each place less than in 1836.

Similar results are shown on the Champlain canal, in the years 1835, 1836, 1837 and 1838, since which latter year the lockages have not been obtained."

The number of miles run upon the canals by all the boats is ascertained exactly by the boat tolls. The miles run by freight boats were greatest in 1838 and 1841—those run by packet boats decreased from 1837 to 1840, and have since increased. The annual average of the whole for the last three years, has increased 530,097 or 276-100 per cent per annum."

The conclusion we give in the words of the document as being too important to admit of curtailment.

"The foregoing detailed evidences of the trade and tonnage of the canals, are the results of a system of statistical returns by the collectors of tolls, put in operation in 1836, and continued to the present time. A recapitulation of the results to which a careful examination of these evidences has led, are as follows:

1. *Total movements, in tons, on all the canals.*

Comparing the last three with the previous four years, the increase is 2 13-100 per cent per annum.

2. *Total movement of boats, in miles, on all the canals.*

Comparing the past three years with the previous three, the increase is 2 76-100 per cent per annum.

3. *Tons arriving at tide water.*

Comparing the last four with the previous four years, the increase is 11-100 of one per cent per annum.

4. *Boats arriving at tide water.*

Comparing the past five with the previous five years, there is a *decrease* of 59-100 of one per cent per annum.

5. *Lockages at the lock three miles west of Schenectady, called Alexander's lock.*

Comparing the last four with the previous four years, the increase is 1 53-100 per cent per annum.

6. *Tons of merchandize ascending the canals.*

Comparing the last four with the previous four years, the increase is 1 42-100 per cent per annum.

These, it will be observed, are six separate and distinct tests of the condition of the trade and tonnage of the canal in the last three, four and five years, as compared in each case with the previous three, four and five years.

Tests numbers 1 and 2, relate to the *total movement* of all matter on all the canals to and fro, whether coming to tide water or not, both showing an increase of over two, and less than three per cent per annum.

Tests 3, 4, 5, and 6 relate only to the property arriving at and going from tide water, showing an increase in the tons of arrival, of only 11-100

of one per cent per annum, and a *decrease* in the arrival of boats of 59-100 per cent per annum.

The lockages at Alexander's lock, as has been before observed, were doubtless increased in 1839, '40 and '41, by the temporary transportation of stone for the enlarged locks.

But while there has been less than 3 per cent average annual increase in the *total movement* on the canals in the last three years, and only 11-100 of one per cent increase in tons, arriving at tide water, there has, in the same time been an average annual increase of over 7 per cent per annum in the tolls received on all the canals.

The increase of over two per cent in the total movement on all the canals, is not only reconcilable with the stationary condition of the tonnage arriving at the Hudson, but is in perfect harmony with it. The increase of population in the interior, while it contributes to the internal trade of the canals, by an exchange of commodities between different sections of the country, at the same time creates a demand for those bulky products of the forest, and those products of agriculture, which, at an earlier period and with a sparser population, are sent to the sea board.

The relative proportions which the tons of the different classes of articles arriving at tide water in the last eight years bear to each other, are as follows:

	Per cent.
Products of the forest,	60 39
Agriculture,	31 54
Manufactures,	1 69
Merchandize,	09
Other articles,	6 29
Total,	100 00

It has been shown that the increase in tons of agriculture arriving at tide water just about keeps pace with the decrease, in tons, of the forest, and that as those two sources furnish about 92 per cent of the tonnage, the average delivery at tide water for the last four years has been about stationary.

It has also been shown that the increased delivery at tide water of wheat and flour is but just about equal to the increase of those staples from the western States by the way of Buffalo and Oswego, thus showing that the surplus production of our own State is stationary.

The commissioners are not prepared to say that the results of the last four or five years, as compared with an equal number of previous years, are to be taken as a sure indication of the future. The evidences of the comparative condition of the trade and tonnage of the canals are given as they find them in an authentic shape. They are the only *facts* on record—the *only basis* of an estimate for the future. Resting upon the results and assuming as it is safe to do, until the results of other years are obtained, that they are correct indices of the future, the commissioners are led to the following conclusions:

1. That owing to the diminution of the forest, the tonnage arriving at tide water, over the most crowded portion of the canal, has nearly if not quite reached its maximum.

2. That owing to the decrease of the forest and to the practice of carrying larger cargoes than formerly, the arrival of boats at the Hudson river, which has *decreased* one half of one per cent per annum in the last five years, is not for a long time to exceed the average of those years, which have been accommodated by a single lock.

3. That as 30,000 lockages can be made in a season of navigation by a

single lock, as has been tested at Alexander's lock, through which the tonnage arriving at tide water on the Erie canal passes—as the largest lockage at any one lock west of Utica, is at the Syracuse lock, which has been as follows:

In 1835,	22,258
1836,	21,692
1837,	18,181
1838,	20,383
1842,	19,397

As the lockages at the Lockport locks have been as follows:

In 1835,	10,925
1836,	13,808
1837,	10,041
1842,	11,697

There is reason to suppose that the internal trade of the canals will never task the capacity of single locks.

4. That owing to a change in the character of the tonnage, from the products of the forest to the products of agriculture, which, without increasing the arrival of tons at tide water, has in the last four years, added an average of $355,000 to the tolls; there may, for the same reason, be a further average addition to the tolls, without any increase of tonnage.

The information thus accumulated is of the utmost value to this State—showing as it does, that while the *demands upon the capacity* of the canal are on the decrease, the *revenue* to the State is on the increase. Could the knowledge of these facts have been anticipated a few years since, we may safely say that millions would have been saved. It is not yet too late to profit by it—and we only hope that a continuance of the research manifested in this paper, may in future years be made available for the public benefit.

MR. VIGNOLES' LECTURES ON CIVIL ENGINEERING, AT THE LONDON UNIVERSITY COLLEGE.—SECOND COURSE.—LECTURE XVII, AND LAST.

Before proceeding to a summary of the second course, Mr. Vignoles observed, that there was a material point connected with the subject which had not been sufficiently discussed—viz. the motive power to be employed; on this greatly depended the principles on which a line of railway should be laid out, the end and object being to convey the greatest extent of traffic at the least cost; this cost was compounded—first, of the interest of the capital expended, which should be considered a constant charge; and second, of the periodical working expenses—the work to be done being summed up in the general expression of "overcoming all obstacles to facility of motion." What are these obstacles? They might be divided into two great heads—Gravity and Friction. 1st. Gravity is a natural cause existing under all circumstances, and affecting lines deviating from the horizontal, in direct proportion to the sine of the angle of inclination. Engineers, therefore, have considered that the first principle in laying out roads, should be (under limits) to approximate as nearly as possible to the horizontal, in order to exclude one of the great causes of obstacle; since, with maximum loads, the retardation arising from gravity is most felt. When such could not be effected, then to distribute the total rise (or effect of gravity) along the easiest ratio of slope. But, in practice, the occurrence of maximum loads, in ordinary passengers and merchandize traffic, forms the exception, instead of constituting the rule, and it is only when a regular and constant heavy trade is

to be anticipated that horizontal communications should be insisted on. 2nd. Friction is a physical cause, varying according to the perfection of the road and of the vehicles moving on it. In the practical working of a railway, however, so many expenses arise under the heads of "conducting traffic, management, etc." common to most lines, whatever the gradient, that they tend to make the cost of overcoming friction and even gravity (particularly with the ordinary light loads) but a small fraction of the total charges. Comparing the amount of obstacles on a railway with that on the ordinary road (where the friction, meaning thereby axletree friction and surface resistance, may be called sixteen to twenty times greater than on a railway,) and assuming the inclination on railway and road to be the same, the general result is that the perfection of the railway surface moved over, and the improvement of carriages, or rather that of their wheels and axles, cause the effect of gravity to be felt in the most sensible degree on railways; while the imperfection of the road causes it to be comparatively scarcely appreciated. Hence with the wretched surfaces of the old roads, and the clumsy wheels of our primitive vehicles, the hills seems to have scarcely added to the obstacles to be overcome. As the road surfaces and carriages improved, and increased speed and heavier loads were introduced, the necessity for the greater perfection of the ordinary road became apparent, and the remedy was applied in various degrees during the last 100 years until it was completed as far as possible, in the extensive improvements by Telford and Macneill on our great highways. But in carrying out this principle on railways we have run into the opposite extreme. We should first take in one sum the retarding causes of gravity and friction—viz: the friction, being constant, or nearly so, putting aside the resistance of the air at high velocities, varying only in the perfection of the wheel axles, and in the mode of lubricating, (the surface resistance on railways being, practically speaking, nothing,) and the maximum gradient, or rather the gravity due to it:—their sum will be the constant divisor for the motive-power, of whatever description that motive-power might be; and, in considering the latter point, it must be the distribution of the traffic, or what may be called the average hourly load throughout the year which is to determine the question. In many instances, in this point of view, it would probably often be found most economical to use animal power, (as is done on the Edinburgh and Dalkeith railway,) were not velocity required—which, on railways, enters so materially into the calculation, that mechanical power in some shape becomes necessary; and this divides itself into stationary power, or when too mechanical means are fixed. and locomotive power, or when the machine travels along with the load. There are two serious difficulties connected with the latter system; first, a great addition to the load, equivalent to the average of doubling it; and next, that the fulcrum through which the motive power must be transmitted —that is, the rail on which the locomotive driving wheel impinges—is greatly affected by atmospheric causes, occasioning great variation in the adhesion, and consequent uncertainty from slipping of the wheel, so that, as explained in a former lecture, the load after a locomotive engine is really limited by its adhesive power, and not, as first might be supposed, either by the cylinder power or boiler power. Considered abstractedly, stationary power is cheaper and always would be so if the traffic were certain and regular, with maximum loads and very moderate speed, even with the present obstacles of ropes, sheaves, and all their contingent complicated apparatus; but at high speed, with a great length of rope, the experience of the working of the Blackwall railway has shown that for passenger trains only, there was, compared with the most expensively worked lines on the locomotive system, to say the least,

no economy in the motive power, though other conveniencies arising from the peculiar arrangements on that line, were, perhaps, in this special case, more than equivalent. A most serious obstacle to stationary power, was the necessity of absolutely stopping, and disengaging and refixing, the trains at each station, which stations could not be conveniently, and certainly not economically, placed further apart than three to five miles, for it could readily be proved, that on a continued distance of six or seven miles of railway worked by a rope, the power of the largest engine that could well be erected, would be absorbed in moving the rope only. The Professor then went largely into a consideration of applying stationary engines as the motive power in working inclined planes under a variety of circumstances, and recommended to the students to consult the valuable work of Mr. Nicholas Wood on this subject, and indeed on all the details of railway working, of which, particularly in the third edition, there was most of the latest information. In many situations, however, where water power could be obtained, the stationary rope and pulley system might be advantageously introduced. Gravity became the motive power, on what were called self-acting inclined planes; that is, when the gravity of a descending train of laden carriages brought up a train of others empty or partially laden; or where skeleton wagons, or water tanks on wheels, could be useful as artificial counterbalancing weights in either direction alternately; the circumstances under which self-acting inclined planes could be properly introduced were rare. Mr. Vignoles then gave a clear account of various modes of working self-acting inclined planes; among these was described a curious and interesting one near the great limestone quarries in North Staffordshire; another on the St. Helen's and Runcorn Gap railway, which he had himself put up, and also the planes for the Great Portage railway, across the Allegheny Mountains, in the United States of America. Stationary power might also be used to a greater extent on the atmospheric system, whereby, to speak metaphorically, a rope of air was substituted for a rope of hemp or wire, and where no pullies were required, nor any necessary stoppage at the intermediate engines, where only the carriages had to be moved, and where nearly the whole dynamic force generated was made available for motive power. This system had already been explained to the class, and practically illustrated on a railway thus worked, and need not be further alluded to. The Professor was preparing for publication a separate lecture "On the Atmospheric Railway System," to be illustrated with plates, and tables, and appendices, in which that interesting subject would be fully gone into, and all the mathematical and philosophical investigations given, with estimates of the cost of such railways under various circumstances of traffic and gradient; fully enabling the value of the principle as a motive power, to be appreciated. Although modern practice had almost discarded the use of animal power from railways, it might be proper to refer cursorily to it. A horse seems adapted to drag vehicles, from the mode in which he adopts his muscular action, so as to throw the greatest effect on the line of draft; in making an effort to draw a carriage, the body of the animal is bent forward, throwing upon the latter the part of its weight necessary to overcome the resistance, the muscular force of the legs being employed in keeping up his traction and moving the body onward; the effort of the animal being revolvable into these two parts —viz. the action on the load, and that required to move itself by. It may be gathered from writers on this subject that the force a horse is capable of exerting, is that equal to about one-seventh or one-eighth part of his own weight: or that, on an ascent of one in seven or one in eight, the exertion required to overcome his own gravity, is a force equal to that he is able

to exert on a road on a level plane. Taking the average weight of a horse, and considering that he is capable of occasionally exerting great extra power on the load, still it seems to be satisfactorily ascertained, that nearly seven parts out of eight of the muscular power of a horse is required to drag his own weight forward, leaving, of course, only one part applicable to the load. But the criterion of a horse's power in practice is not the occasional effort of which the animal is capable at a dead pull, or for a short period: we must estimate his strength by what he can do daily, and day after day for a long period, and without breaking him down prematurely. If a horse is to travel at the rate of ten miles an hour his power of pulling is greatly diminished, and he can work only an hour or so in the day: at two miles an hour he may give out a power of 150 lb. on the load: at ten miles he has scarcely 35 lb. to spare, and at 12 miles an hour he can seldom be expected to do more than move himself. This was on the average of horses—all beyond were exceptions. Thus, the application of horses to railways as the motive-power was very limited: and in laying out lines where they are to be used, to full effect, gravity should be arranged to be always with the load, or, at least, not against it; the rate of travelling only 2 or 2½ miles per hour, and the traffic uniform. Mr. Vignoles proceeded to an interesting comparison between locomotive and stationary power up inclined planes, taking the inclination of 1 in 50 as a medium, and showed that *when the traffic was small and the loads consequently comparatively light, and the daily number of trains not great, locomotive engines*, as the motive-power, (taking into consideration all circumstances of first cost, and working expenses—particularly the latter, of which the locomotive power was but a small part,) *would not be so expensive as stationary engines*, while they would be certainly more convenient; and that, with all the best modern improvements in the locomotive engines, the system of working with large cylinders, using the steam expansively on the level and falling parts of the railway, improved boilers, etc., *planes of* 1 *in* 50 *might be practically worked;* the only material drawback being, occasional slipping of the wheels on the ascent, and the necessity of great caution and careful application of the brakes on descents; but on the whole, the balance, *under the above circumstances*, was much in favor of the locomotive system. The Professor then entered into a very long and minute comparison of the present system of working the Blackwall railway by stationary engines, with ropes and pullies, with what would be the case if the motive power were locomotive engines—and by tables, showed that while the working of the Blackwall Railway (3½ miles) on the stationary system, was costing about *seventy-two pence* per mile per train, the cost of working the Greenwich railway (3¾ miles) was only about *forty pence*:—but, Mr. Vignoles admitted, that by the former, great accommodation to the public was afforded by the numerous intermediate stations, while on the latter, there was only one stoppage. In concluding the general comparison between the two principles of mechanical motive-power, the Professor observed that on the locomotive system, a minimum of power need only be provided in the first instance and the number of engines might be increased gradually as the traffic required, which was a great consideration when the first expenditure of capital had to be kept down to the very lowest terms, at all future risks. On the stationary system, provision had been made from the outset, for the maximum anticipated trade, which of course increased the first outlay on the railway establishment, and depended on the ultimate economy of future working to make up the difference. Having concluded the notice of various descriptions of *motive-power* employed on railways, of which the preceding is but a mere

outline, some general remarks were made on the principles of laying out railways, in reference to the several systems respectively.

In a concluding general summary, Mr. Vignoles observed, that in his first course, at the latter end of 1841, he had fully considered the practical rules for earthwork and constructions:—these were not peculiar to railways; the theory and practice of bridge-building, applied to all internal communication, and would be most conviently considered in a separate illustrated course, but he wished to recall to the class generally, that in proceeding to lay out railways in the first instance, the engineer ought to enter much more deliberately into these previous inquiries, so absolutely necessary, than had hitherto been done. A system of applying the same general rule of perfect gradients alike to lines, of the least as well as of the greatest traffic, had too much prevailed, and until more rational ideas were substituted, the public would shrink from embarking in enterprises subject to all the contingencies of extra cost beyond estimates which had characterised almost every railway in this country. *The earthwork and its consequences*, regulated the cost, particularly as regarded contingencies, and the utmost consideration should be bestowed as to how far it was justifiable to encounter the expense of these operations. The average cost of earthwork, and all consequent works of art, etc., on the English railways was nearly £15,000 per mile, or about 50 per cent of the whole capital expenditure. Mr. Vignoles was decidedly of opinion that in *all future lines in this country, and particularly on the continent*, the correspondent outlay *ought not to exceed* £5000 *per mile*, and that beyond that sum perfection of gradient would be bought too dearly. In reference to the *gauge* of railways, Mr. Vignoles stated distinctly, that theoretical investigations and practical results led him to consider a six foot gauge the best; but the present 4¼ foot gauge was certainly rather cheaper. In respect of *curves*, he observed, that they were much less disadvantageous than had been first supposed: that a half mile radius is now everywhere admitted; and that he himself did not hesitate to adopt a quarter mile radius whenever expense could be materially saved; and if the atmospheric system of motive power should be found to succeed on a large scale, the curves might, on lines thus worked, be safely made still sharper. In regard to the systems of constructing the *upper works*, he had in a recent lecture, entered so fully into the comparison, that he need only now say, that if the expensive and complicated system of heavy rails and chairs, and cross sleepers, were preferred by engineers, then the ingenius improvements of Mr. May, of Ipswich, in chairs and fastenings, applied by Mr. Cubitt on the South Eastern (Dover) railway, with great care in laying, draining, and ballasting, made *that system* perfect and complete. The Professor, however, decidedly gave the preference to the less costly, and the more simple system of lighter rails, without chairs, laid on continuous longitudinal balks of timber of sufficient scantling and fastened on Evans's principle, modified in the manner shown by the models exhibited to the class; and several engineers were adopting this opinion. On the continent of Europe, where iron was dear, and timber cheap and abundant, Mr. Vignoles calculated *a saving of full* £2000 *per mile of double road would accrue from the adoption of the latter system*—which afforded a vast national economy. In reference to the subject of working drawings, plans, and sections, the Professor reminded the class of the importance he attached to having all such previously made out on a large scale, that the cubic quantities might be accurately obtained, and the just prices considered; and thus, in proceeding to make the estimates, nothing would be left to conjecture, and as little as possible left to be afterwards altered. The period of time for the execution

of the works should be extended as far as consistently could be done. The two great sources of the extra expenditure on railways had been, the extreme haste with which the work had been pushed on, and the changes of every kind from the original designs. These points being all carefully considered, *even before the plan was brought before the public in general*, the estimates might be better depended on. Mr. Vignoles then went through all the great items of expenditure generally arising on first construction, and explained how the accounts of measurements should be made out and kept under very distinct general heads, subdivided into minor items, from the purchase of the land to the last finish to the stations, and the entire fitting up and furnishing of the carrying establishments. Sufficient experience had been attained in all these matters to enable the engineer, in future, if the above rules were faithfully followed out, to place himself beyond all chances of reproach for making erroneous estimates. In conclusion, the Professor observed, that he had selected railways at the request of the class, as the theme for the course just concluded; but although so much consideration had been given to the subject, he had only been able to touch in a very general way upon the chief points; yet it was to be hoped a sufficient idea had been given of the principles of construction, and of their general application, to create an interest in their minds. Should any of the students hereafter be employed to execute a railway, he trusted they would recollect these lectures with advantage, while they would also probably better understand and appreciate them: at the same time, he must not neglect to impress upon them, that it was not at the college, in the lecture-room, or even in the office of an engineer, that all the duties and knowledge necessary could be taught: the young aspirant must pass much time in the work-shop, indeed, he must become a workman, and acquire the use and skill in the handling of tools, and the erection of mechanism of every kind—and passing to the actual works, ought to learn to be able to direct personally the labor of the mason, the carpenter, and the smith. "Above all," said Mr. Vignoles, "the student in engineering must carry into life with him the constant remembrance of what I have so repeatedly enforced, that the reputation of an engineer in this country is based upon the success of his works, of his mechanism, and of all the efforts of his mind and hand, and in respect to, and in proportion to their being productive of commercial and beneficial results, to those who, at his suggestion, may undertake to provide the necessary funds: and he should consider how this result can be best obtained, rather than study the splendor of his undertakings. It is for the architect to attend to the decorative and the beautiful; it is sufficient for the engineer to study proportions, and rely on the simple grandeur of his works as a whole. It is related that Napoleon once observed to the celebrated Carnot, "*Les ingenieurs doivent toujours avoir des dees magnifiques;*" this is true as to their first conceptions, but in the realization, they must be sobered down by the rules of economy and judgment. After the first burst of talent, after image and form has been given by the hand to the bright idea emanating from the brain, let it be brought out to practical application only after a strict inquiry into the cost. Remember what I quoted on a former occasion, when contrasting the two celebrated light houses, the *Eddystone Cordouan*—no unfit emblem of the two celebrated engineers who erected them may I venture to add of their respective nations—remember, I say, "*'tis use alone that sanctifies expense.*"

REPORT OF THE PATENT COMMISSIONER.

We give the Patent Office Report entire in this number—but the docu-

ment as presented to Congress contains a vast amount of information relative to the products of our country, and will furnish us with several themes upon which to discourse in future numbers.

PATENT OFFICE, January, 1843.

SIR: In compliance with the law of Congress, the Commissioner of Patents has the honor to submit his annual report.

Five hundred and seventeen patents have been issued during the year 1842, including *thirteen* re-issues, and *fifteen* additional improvements to former patents, of which classified and alphabetical lists are annexed, (marked B and C.)

During the same period three hundred and fifty-two patents have expired, as per list marked D.

The applications for patents during the year past amount to *seven hundred and sixty-one*, and the number of caveats filed was *two hundred and ninety-one.*

The receipts of the office for 1842 amount to $35,790 96, from which $8,068 95 may be repaid on applications withdrawn, as per statement E.

The ordinary expenses of the Patent Office for the past year, including payments for the library and for agricultural statistics, have been 23,154-48, leaving a nett balance of $5,264 20, to be credited to the patent fund, as per statement marked F.

The above expenditures do not include those incurred within the last year for the recovery of the stolen jewels.

For the restoration of models, records and drawings, under the act of March 3, 1837, $14,060 02 have been expended, as per statement G.

The whole number of patents issued by the United States, previous to January 1843, was *twelve thousand nine hundred and ninety-two.* The continuance of the depression of the money market, and the almost universal prostration of all business, operates very disadvantageously on the receipts of this office, as many hundred applications are delayed solely from the want of funds or difficulty of remittance. The patents granted for the year, however, exceed those of the year previous by *twenty*, though there have been less applications by *eighty-six.*

The Digest of Patents, continued and brought down to January, 1842, has been printed, and 700 copies distributed to the respective States, and 200 copies deposited in the library, in compliance with the resolution of Congress directing the same.

The accommodations granted during the last year for the reception of the articles received through the exploring expedition, intrusted to the National Institute, must seriously thwart, if not suspend, the design of Congress in the reorganization of the Patent Office, which enacts, section 20, act of July 4, 1836, "that it shall be the duty of the commissioner to cause to be classified and arranged in such rooms and galleries as may be provided for that purpose, in suitable cases, when necessary for their preservation, and in such a manner as shall be conducive to a beneficial and favorable display thereof, the models, and specimens of composition and fabrics, and other manufactures of work and art, patented or unpatented, which have been or shall hereafter be deposited in the said office.

While the annual receipts of the Patent Office above the expenditures are sufficient to carry out fully the benevolent object of the National Legislature, the want of room of which it is thus deprived will be, for a time, an insurmountable obstacle, as all the rooms in the gallery could be advantageously used either by the Patent Office or the National Institute. No

remedy, therefore, remains, but an extension of the building, which might be done by the erection of a wing sufficiently large to accommodate the Patent Office on the first story. The building can also afford room for lectures by professors, should they be appointed under the Smithsonian bequest; and may I be permitted here to observe, that a gratuitous course of lectures in the different branches of science would certainly do much to diffuse knowledge among men. I can confidently say that the agricultural class look forward with bright anticipations to some benefit from the Smithsonian bequest, and to the time when the sons of agriculturists, after years of toil at the plough, can attend a course of lectures at the seat of government, and there learn, not only the forms of legislation, but acquire such a knowledge of chemistry and the arts as will enable them to analyze the different soils, and apply agricultural chemistry to the greatest effect. Such encouragement will, indeed, stimulate them to excel in their profession, while others, deemed by many more favorable, are indulged with a collegiate course of education. Little, indeed, has been done for husbandry by the General Government; and, since eighty per cent of the population are more or less engaged in this pursuit, the claim on this most beneficent bequest will not, it is hoped, be disregarded. The National Agricultural Society, in connection with the Institute, will most cheerfully aid Congress in carrying out their designs, for the great benefit of national industry.

It is a matter of sincere congratulation, that the Patent Office has so far recovered from its great loss in 1836, by the conflagration of the building, with all its contents. A continued correspondence with 11,000 patentees, and untiring efforts on the part of all concerned with this bureau, has accomplished much; indeed, to appearance, the models are better than previous to the fire. Although something remains yet to be done, enough has been accomplished to remove the past embarrassment, and afford applicants the means of examination as to the expediency of applying for a patent.

The loss to the library, sustained by the fire, is not yet fully repaired; and, since the law of 1836 makes it a duty to examine all applications for patents, with reference, also, to foreign inventions, it is absolutely necessary that the library should be extended.

It is true that the library of Congress possesses some books on scientific subjects, useful for reference in the labors of this bureau, but no permission is given to take out books from that library; and, if such liberty were granted, it would be bad economy to send an examiner to the capitol, to look up similar cases. If applications are to be examined, it will promote the despatch of public business, protect against spurious patents, and give public satisfaction, if the Patent Office library is well supplied with necessary books.

Already, hundreds of applicants are satisfied, by the comparatively imperfect examinations now made by referring to books on hand, not to take out a patent, and when, in the rejection of cases, reference is made to foreign patents, there is an impatient desire to see the description of the invention that is to cut off the hopes of so many years of toil and labor. I would therefore most earnestly recommend an appropriation of $1,200, from the surplus fund, to add to the Patent Office Library.

The annual agricultural statistics comprising the tabular estimate of the crops for the past year, with accompanying remarks and appendix, will be found subjoined, (marked A:)

The value of this document to the whole country, from year to year, it is believed, would justify a much larger appropriation from the Patent Office fund for this purpose. The diffusion of such information may save

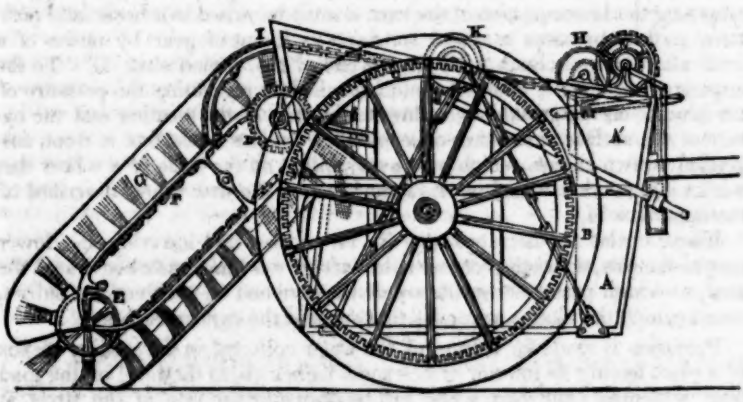
millions to the laborious tiller of the soil, besides adding directly to his means of export many millions more. An examination of this subject, and the expediency of fixing it on a more permanent and advantageous basis, by the constitution of an agricultural bureau, or at least an agricultural clerkship, at a moderate expense, to be drawn from the patent fund, is respectfully suggested. The additional benefit which must thus accrue to the population of our widely extended country would soon be seen.

A sufficient appropriation to allow a personal examination of the various parts of the country, by some one well qualified for such duty—similar to what has been attempted with so much success by some of the State legislatures—would, it is believed, realize a vast amount of practical good to the South and West, by furnishing the data on which they might direct their products to the best market, for domestic sale or foreign export.

Such, indeed, are the great benefits to result from personal observation and critical examination, not only of the crops, but agricultural implements—such the importance of explaining the new improvements, and collecting and distributing all the acclimated seeds, which are proved to be so signally productive or beneficial, that the Commissioner of Patents has doubted whether a modification of his duties, in connection with the Patent Office would not be more useful to the community. During the last year, he embraced the opportunity, while travelling to examine the crops in ten States; and though the examination was of course imperfect, it enabled him the better to digest the somewhat discordant materials from which the agricultural statistics here incorporated were compiled. If millions can be saved to the public, if the agriculturist can be encouraged in his all-important pursuits, by the expenditure of a small sum from the annual surplus of the patent fund, what better destination could be given to this amount? Would not the people heartily approve and earnestly second such an undertaking?

All which is respectfully submitted.

H. L. Ellsworth.



WHITWORTH'S PATENT SWEEPING MACHINE.

This machine, lately brought into operation in the town of Manchester, where it excited a considerable deal of public attention, has lately been introduced into the metropolis, and is now employed in cleaning Regent street. It is the invention of Mr. Whitworth, of the firm of Messrs. Whitworth & Co., of Manchester, engineers, by whom it has been patented. The principle of the invention consists in employing the rotary motion of locomotive

wheels, moved by horse or other power, to raise the loose soil from the surface of the ground and deposit it in a vehicle attached. The apparatus for this purpose is simple in in its construction; it consists of a series of brooms (3 ft. wide) suspended from a light frame of wrought iron, hung behind a cart, the body of which is placed near the ground, for greater facility in loading. The draught is easy for two horses, and throughout the process of filling, scarcely a larger amount of force is required than would be necessary to draw the full cart an equal distance.

The following description of the machine by a reference to the accompanying engraving, will explain its action. The cart is constructed with plate iron, and consists of two parts, A, A; the lower part A is suspended to the upper part, and when filled is lowered and replaced with an empty one. To the off-side wheel B, is attached, on the inside, a cog-wheel, C, which works into a pinion, D, on the end of a shaft the length of the back part of the cart, and fixed thereon are two pullies 1 ft. diameter and 2 ft. 4 in. apart: two other corresponding pullies, E, are fixed upon a lower shaft, which is suspended to the upper shaft by a wrought iron frame, and over these pullies pass two endless chains, F, to which the broom G, consisting of 29 rows, each 3 ft. 4 in. long, are attached. It will thus be seen, that when the large wheel of the cart is set in motion, it will, by means of the large spur wheel C, turn the pinion D, and with it the pullies and the endless chain and brooms that pass over them: and as these brooms come in contact with the road, they sweep the mud up the inclined plane into the bottom part of the cart A. For the purpose of raising the brooms from off the ground, there is an apparatus H, consisting of an endless screw working into a level wheel upon a shaft which passes across the top of the cart: upon this shaft are fixed two pullies, to which are attached two chains, which pass along the top of the cart and over the quadrants I, at the back, and there fixed to the iron frame of the apparatus,—so that when the endless screw is turned the chains are coiled round the pullies, and raise the apparatus to any height it may be requisite. For the purpose of removing or emptying the lower portion of the cart, it must be raised to a horizontal position; as this apparatus is raised it throws itself out of gear by means of a lever attached to a clutch fixed on the end of the pinion shaft D. To the apparatus H, there is another motion attached for regulating the pressure of the brooms on the ground, according to the state of the weather and the nature of the surface, consisting of a series of weights in the box in front, suspended to two chains, which pass over pullies on the axle of a wheel that works into another wheel on the same shaft as the first wheel described of the apparatus H.

There is also another apparatus K, for raising and lowering the lower part of the cart, consisting of an endless screw working into a cog-wheel, the shaft of which passes across the top of the cart, and on each end are pullies, round which the chains are coiled that suspend the cart on each side.

Provision is made for letting off the water collected in the cart, by means of a pipe, having its interior orifice some inches above the level of the mud after settlement: the cart, when full, is drawn to the side of the street, at some distance from a sewer grid, and the pipe plug being withdrawn, the water flows into the channel. A slight modification of the original form of the machine, by bevelling the cogs of the large spur wheel, C, throws the machinery more to the near side, and enables it to sweep close up to the curb-stone of the foot pavement; and the hands before required to clean out the gutters are now dispensed with. An indicator, attached to the side of the sweeping apparatus, shows the extent of surface swept during the day, and

acts as a useful check on the driver. It also affords the opportunity of hiring horses to work the machine over a given quantity of surface, the rate of hire being per 1000 yards actually swept. This will be found convenient where parties working the machine do not keep their own horses, and will tend to facilitate the introduction of the new system under management of the local authorities.

When provision cannot conveniently be made in large towns for deposit in yards at proper intervals, the patent machine is constructed of two parts, as above described, viz., an upper A′, carrying a sweeping apparatus, and a lower A, consisting of a loose box, suspended from the upper, and capable of easy detachment. Each machine having two or more of these boxes, A, may be kept constantly at work, depositing the full box in a suitable place, and taking up an empty box before provided,—a skeleton cart being afterwards employed to convey the loaded boxes to the place of ultimate deposit. No difficulty has been found to arise in the management of the machine by ordinary drivers. It has been worked regularly on every kind of street surface—the round and square set stone,—the Macadamized road,—and the wood pavement; all of which are found in the districts before mentioned. Its peculiar advantage, as applied to wood pavement, in preventing the slippery state of the surface so much complained of, has attracted particular attention and will, no doubt, tend to facilitate the general introduction of that useful invention. By the use of proper precautions in cleaning and oiling the machine before setting it to work, the friction of the working parts may be materially reduced,—a point of great importance, in reference both to the consumption of horse power, and the cost of repairs. The wear of the brooms, which at first was considerable, has been diminished more than one-half, by the action of the regulating weights before mentioned. A product of South America, called by the Portuguese "Piassava," forms an excellent material for the beard of the brooms, having great pliancy and strength combined, and also remarkable degree of durability.

Two machines are advantageously worked together, one a little in advance of the other. Not only is the operation of cleansing a particular street thus effected more rapidly, but the two drivers can occasionally assist each other, and one of them (at higher wages) may exercise a supervision over both machines.

The success of the operation is no less remarkable than its novelty. Proceeding at a moderate speed through the public streets, the cart leaves behind it a well swept track, which forms a striking contrast with the adjacent ground. Though of the full size of a common cart, it has repeatedly filled itself in the space of six minutes from the principal thoroughfares of Manchester. This fact, while it proves the efficiency of the new apparatus, proves also the necessity of a change in the present system of street cleaning.

SUSQUEHANNA AND DELAWARE RAILROAD.

We have had placed in our hands "A Report of the survey of a route from the proposed Susquehanna and Delaware railroad—from Pittstown on the Susquehanna through the centre of the Lackawannock coal formation in Luzerne and extending through parts of Pike and Northampton counties, Pennsylvania to the Delaware river at the Water Gap—with an estimate of its cost by Ephraim Beach, Esq., Civil Engineer," with remarks on the same by the Pennsylvania commissioners and Henry W. Drinker, Esq.

This admirable project has slept for a long period. It was surveyed in 1831. As a record of the formation of that part of Pennsylvania, and for reference, we give Major Beach's survey, with some extracts from the views taken by the commissioners, as to the advantages of the route, and the cost of transportation—which at that time was entirely heterodox, and looked upon as the dream of a visionary, to state that coal could be transported with profit at 2½ cents per ton per mile, when it is now ascertained that on the Philadelphia and Reading railroad they can do it for one-fourth of this sum—andover the Boston and Albany railroad, where their grades are as high as 85 feet, they transport at 1¾ cents per ton per mile.

We find there are two roads in New Jersey seeking extension to the Delaware river, and finally to connect with this projected railroad to the coal regions of Luzerne county, the one extending from Newark by Morristown, and the other from Elizabethtown to Somerville. There are no opposing obstacles to a railroad but a bridge over the Delaware, to reach both hard and soft coal. It is undoubtedly the shortest, the best and most level line from the city of New York to the Upper lakes, with the exception of the northern line by the pass at the Little Falls, Herkimer county, New York. From thence to near the foot of Niagara Falls, nearly a level can be obtained, on and near the ridge road—the supposed former shore of lake Ontario. On this line, as it can be formed with a descending grade from lake Erie at Buffalo to the Hudson, no route from the seaboard to the west can compete with it.

The route in question, with the exception of three planes, to be operated by water power, but which we learn have been dispensed with, at a less grade than those on the Massachusetts road—leads through the best part of New Jersey for agricultural and mineral paoducts. Independent of the coal and iron of Pennsylvania, there are extensive forests of the best white, yellow and spruce pine, with other valuable timber, the necessity of which to advance the growth of this city, will make lumber a great item of freight and profit to the road.

This is not all—now that a difficulty and legal questions have been raised between the Hudson and Delaware canal and New York and Erie railroad, which threaten to drive the latter into Sullivan county, and if persisted in may prostrate or delay for a long period the construction of this work, it is a matter of much importance to the citizens of New York to encourage the construction of the Susquehanna and Delaware railroad, as an enterprise that will take produce and merchandize in 181½ miles from Hoboken to the Great Bend, on a line much shorter than via. Piermont, to lake Erie.

	Miles.
From Jersey City via. Paterson to the Water Gap,	81
From the Water Gap to the coal region, in quantities,	53
From thence and the mouth of Leggett's creek to the Great Bend, as surveyed by J. Seymour,	47½
	181½

Twelve miles from the mouth of Leggett's creek will connect this line with Carbondale. The distance to Tioga Point or to Athens near the State line from Jersey City has been ascertained to be 232 miles.

The commissioners remark, pages 35, 36 and 37:

"By the Susquehanna and Delaware railroad and its connections, we conceive the wants and interests of the western New York will be better accommodated than by any other line which has yet been, or indeed that can ever be projected. A connection with the inexhaustible bodies of the coal of Luzerne county, it is scarcely necessary to say, will soon be as vital to the interests of Western New York as to her great and splendid commercial capital; while the same line that amply supplies these wants affords a most extended market for her agricultural produce, and at the same time connects the interests of that State (by the shortest possible line) with the parent city, whose position and commercial advantages are without a rival. The certain improvement of the Susquehanna to the State line, leaves the great question to depend alone on the success of our contemplated undertaking—an undertaking which has in its favor, as is conceived, unrivalled advantages.

"Entering at the western extremity a coal field, he extent and facilities of which are without a parallel—connected by the most direct lines pronounced practicable, and by improved channels already in operation, with the two greatest cities in America, we appear to have from these alone all the advantages, that in other cases have been found to produce ample remuneration, and to render valuable, investments in all undertakings where coal has been the basis of the trade.

"By a section of the Susquehanna river the south western counties of New York would be fully accommodated, while one of the lines which have recently been examined by Mr. Seymour to the Great Bend, would perhaps be more desirable to other parts of the State, to Owego, Ithaca, etc.

"Much has been said and written on railroads and canals, alternately aiming to prove the superiority of the one over the other; it seems probable that difference of situation and circumstances may prove both parties to be right. *But a union of the two in our climate, and where it can be avoided seems generally undesirable.* It is in effect the union of January and May. And when heavy articles, and particularly coal, constitutes the bulk of the transportation, it seems additionally undesirable.

"To a great extent a railroad must lay idle during the closing of a canal, forming part of its line, whether this be three or four months of the year—it is in either case unprofitable.

"It is a loss of so much interest on the capital expended, and is chargeable with a proportion of the loss of attendance and of the decay of the work. It is attended by many other disadvantages and probably does not afford that perfect communication which the advanced and advancing age seems to demand.

"Under this view it does not appear improbable that this line, at no distant day, will be united by continued railroad, with both Philadelphia and New York.

"The value of a continued railroad to a city during the winter season, has in some degree been developed by the recent operations of the Baltimore and Ohio work; longer experience will exhibit other valuable results. Railroads, while accomplishing the object of affording constant and steady winter supplies of fuel at uniform prices, which to the poor and to a part of the middling classes (whose means arise from day to day) is very desirable.

would at the same time afford supplies of many articles tending to increase the comfort and convenience of the citizen, and to add value to a city winter residence. The earliest and latest fruits of the earth, and the products of agriculture would more freely abound, and be afforded at more equal and moderate prices; fresh milk, fresh butter, so desirable would always be attainable; game from the interior, in fine and perfect order, would reach the market in its season, and the enjoyments of the table would be increased. To the country on the other hand, fish, oysters, and the produce of the sea, would be liberally distributed, and indeed it would appear that the condition of all in town and country would be much improved, nor would the effect be less beneficial to the citizens and to the public at large in other respects; trade and commerce would be invigorated; the stagnation that is now felt between the fall and spring sales of various merchandize would in a degree be removed, the demand would be more timely and more extensive, the purchases less hurried and more considerable. The railroad system would tend much to equalize the periods and amount of labor, to distribute human effort more equally throughout the seasons; at the present, in the late fall months, and as we approach towards the close of the year, there exists for a time very active, perhaps excessive employment, much to do, perhaps an insufficiency of laborers, every thing hurried, and often imperfectly accomplished.

"Then, as the severity of the winter closes around us, we experience a state as unprofitable to the citizen as it is injurious to the public morals; a state by which every one loses, by which no one gains; an evil is at once created —the formidable evil of having nothing to do. It seems to be an unerring law of our nature, that wherever this state of things exists, the moral scale of humanity is inevitably lowered: it lays above all things at the root of poverty and pauperism; to remedy which, volumes have been written, and millions have been expended. Railroads have at least this advantage, that they do not add to the number of winter idlers, which cannot with the same truth be asserted of canals."

With respect to cost of transportation we find at that early period the following observations—pages 28, 29 and 31:

OF THE COST OF TRANSPORTATION.

"On this question we have seen very few distinct and intelligent statements by American Engineers.

"Even on canals the cost of transportation presents nothing uniform, but is affected by the location, capacity, and construction of the several works. On some of the Pennsylvania canals, the calculations result in a cost of one half cent per ton per mile, while in other cases a much higher rate is assumed. Captain Beach does not go into any minute examination of the subject; he states generally the average of tolls and transportation on the canals 2½ cents per ton per mile, and these charges are noted as probably appliaable to the Susquehanna and Delaware railroad.

"As the cost of transportation will materially affect the price of coal at market, we are desirous, if possible, of arriving at more distinctness on this point.

"Some recent English publications reduce the cost of transportation on railroads to apparently so small an amount as to have excited doubts of the correctness of their estimates, an examination however of the separate items of charge, etc., on which these estimates are fonnded, in a great measure remove these doubts. In a note appended to "A Report descriptive of a route for a rail road from the Hudson, through Paterson to the Delaware river

at the Water Gap, and made by Col. Sullivan," we find the following: Mr. Booth in his account of the Liverpool and Manchester railroad computes all expenses, *including assisting engines at the inclined planes*, the water stations, and 7½ per cent interest on capital, supposing full employ, at 164-1000ths of a penny per ton per mile," a little more than three mills of our money.

"Mr. T. Earle, in his recently published treatise on railroads, estimates the performance of a single horse to be equal to the transport of 416 tons, one mile per day, making sufficient allowance for wagon hire, and for horse and attendant we find the transportation on a railroad by animal power to be about half a cent per ton per mile.

In the Report of the Pennsylvania Board of State Canal Commissioners on the Carbondale railway it is stated—

"The Company at a profit transport across the 16 miles of railway, at 35 cents per ton, exclusive of the toll." From other data furnished by the same report, it is evident that this charge might be reduced and leave sufficient to pay expenses. In another statement made at a different time by the engineer of that company, as cited by Col. Sullivan, the expenses of conveyance over the 16 miles of rail, requiring five stationary steam engines, is reported at 29½ cents. It is perfectly evident that these calculations have been predicated upon the actual amount transported, or expected to offer for transportation, at different periods during the year; and they are not based upon any estimate of the ascertained or probable capacity of the railroad. It is also equally manifest, that the cost of transportation over 16 miles, including *the whole ascent* in the direction of the trade, cost, fuel, and attendance at five stationary steam engines, with their ropes and apparatus within that distance, cannot furnish data for estimating the aggregate cost of transportation on a longer line comprising far more favorable sections—level planes, and all the descents.

"To throw some additional light on this subject, we avail ourselves of some data furnished by Mr. Seymour, in his report on a survey made by him in May, 1831, for the Lackawannack and Susquehanna railroad. In addition to his own authority we have the concurrent testimony of an engineer upon the only line of railroad improvement on our side of the water, which has as yet afforded experimental and practical illustration.

Mr. Seymour remarks—"It gives me pleasure to add, that upon showing the estimate to Mr. Archibald, the engineer for the Hudson and Delaware Canal Company, it met with an almost exact concurrence of opinion."

"We, therefore, conclude that, on favorable railroad lines, half a cent per ton per mile would probably meet the necessary expenditure for transportation, and that 1 cent per ton per mile will be an ample and sufficient estimate for the freight upon the Susquehanna and Delaware railroad when fairly in operation. The provisions of the act of incorporation give no limit to the charges for transportation, nor are we restricted to any per centage in this particular, all persons have liberty to use the railroad and transport upon it, they using the carriages, etc., as prescribed by the campany."

NEW YORK AND ERIE RAILROAD.

The bill in aid of this road having passed the last legislature, arrangements are about being made preparatory to recommencing the work. This bill, the details of which have been before published in this Journal, postpones the sale of the road to 1850, and so far releases the State lien on the

work as to allow of other loans taking precedence of the three millions of State loan.

Meanwhile the residents along the line for several miles beyond Goshen, prompted by a sound and judicious policy have completed the road in their section at their own cost.

IRON CANAL BOATS.

In your March No. 354, vol. X., page 173, I gave you a short article on this subject, and expressed the wish "that some of our enterprising forwarders will try the experiment of Iron Canal Boats." I am gratified to find a morning paper has the following, showing the complete success of this class of boats. In another article I proved, that their light draught of water, with increased cargo, would so add to the capacity of the Erie canal, even without taking into view the rapid decrease of the forest, as to render the enlargement of the Erie canal entirely unnecessary. This was more than two years ago. It is desirable to ascertain the cost of an Iron Canal Boat, compared with our best lake boats—the draught of water in each, with tons carried.

IRON BOATS AND ERICSSON PROPELLERS.

"New and wider spheres of enterprise open upon us every year; and none has been more marked in this respect than the present year. We found yesterday at one of the lower piers in South street, the iron boat Pilot, with Ericsson propellers, (belonging to Mr. Asa Worthington, of the Hope Mills in Front street,) loading for St. John, at the farther end of lake Champlain. She is the first boat which has done this. Freight she has offered much more than she can carry. At Coentie's Slip lay a large schooner with Ericsson propellers loading for Hartford, Ct. Iron boats now load at Philadelphia with coal, and proceed to Troy or to any other point where their cargoes are wanted, and then load again with salt or whatever else is offered in return. The effort to avoid transhipment is constantly succeeding more and more, and boats are being built which can pass through all varieties of navigation. To work cheaper and to work faster is the thing to which every one aims."

☞ Our canal commissioners should institute this enquiry. The expense would not be much and would lead to important results.

J. E. B.

STATISTICS OF LAKE STEAMERS.

The Buffalo Commercial Advertiser, on the completion of a quarter of a century since the first steamer was launched upon the western lakes, give a list of the steam vessels now on those waters. The total tonnage is 27,000, the cost $3,510,000 or $130 per ton.

The following remarks which we extract will prove interesting:

"In examining the progress of steam, as applied in propelling vessels on the lakes, we are struck with the very small number of disasters when compared with other sections of the country, especially on the western waters. In the whole period of 25 years there have been but four explosions which might be termed serious. It is true there are other disasters to re-

cord, whose calamitous details are too freshly impressed upon the public mind. The following tabular view presents both these classes:

Explosions—Lives lost.		*Burned—Lives lost.*	
Peacock, September 1830,	15	Washington, 2d June, '38,	50
Adelaide, June, 1830,	3	Erie, August, 1841,	250
Erie, August, 1840,	6	Vermillion, Nov. 1842,	5
Perry, twice in 1835,	6	Caroline, (wilful)	5
Total,	30	Total,	310

The number of boats yet remaining of the whole once in commission on lake Erie and the upper lakes is about sixty, with an aggregate of 17,000 tons. Of these some thirty-five only are used when the consolidation is in existence.

Of the whole number of boats in commission during the above period only ten were built and owned in Canada.

The first steamer known to be upon lake Michigan was the Henry Clay. In August, 1827, an excursion of pleasure was made in her to Green Bay, where Gov. Cass was holding a treaty with the Winnebagoes. After the treaty was concluded, Gov. C. and suite returned in the Clay. From that period to 1832 some of the boats went to Green Bay, but no further. On the breaking out of the Black Hawk war several of the larger boats were chartered by the government to convey troops to the disaffected territory, and Chicago for the first time was greeted with the sight of one of those strange visiters.

From the following notice we learn that two men, L. A. Sykes and Geo. S. Mills, have leased the Morris canal. From the enterprise and intelligence of these gentlemen we have no doubt that this work will be judiciously managed, and we hope with profit to the lessees.

"The Morris canal is again in navigable order, and business has been resumed through the enterprise of the new lessees, Messrs. George S. Mills and L. A. Sykes, with good promise of a brisk and profitable season. Full supplies of coal will, we understand, be sent down to market through this channel from the Lehigh mines by the Pennsylvania companies. We are also gratified to learn that the iron business at the various establishments on the route has been resumed and is to be extended during the season. The Stanhope Works are to be put in full operation, and, in addition to the old works at Boonton, a large nail factory is now in progress by a New England Company, which will be completed in the course of 60 days, and which is then expected to turn out some tons of nails daily. Preparations have also been made for the transmission of large supplies of ore from the rich iron mines of Morris county. There is very little, if any richer ore in the country than that furnished by Gov. Dickerson's mines at Sucasunna."—*Newark Daily Advertiser.*

THE PYRAMIDS OF GIZEH.

At the Royal Institute of British Architects, on the 6th ultimo, a letter was read from Mr. Perring, containing some remarks on the great Pyramid, accompanied by a model.

The model is on a scale of 30 feet in the inch, and represents the pyramid in its original condition,—that is, immediately after the sarcophagus was placed therein, and before the passages were filled with stone blocks closing the entrance. From an examination of the ancient Egyptian cubit, now remaining, I deduced the length to be 1·713 English feet divided into

four palms, each of seven digits. This measure, when applied to the pyramids, agrees as closely as to render its correctness certain, and I proceed to mention a few of the more obvious results in the edifice before us. The base covered a square of 448 cubits on each side, which, from a statement of Pliny, I take to have been equal to eight Egyptian jugera, or acres; and this supposition is somewhat confirmed by finding the second pyramid would then cover seven, and the third, one and three quarters of these supposed jugera, and so on with the other pyramids of Egypt. The height of the great pyramid appears to have been 280 cubits, being a proportion of height to side of base of 5 to 8; and I may here mention that several other pyramids have the same proportions. This gives the following ratio on a direct section: As half the base is to the perpendicular height, so is the apotheme, or slant height to the whole base; or for each side it may be thus stated as

Rad : Tang : : Sec : 2 Rad.

"Sir John Herschel having the angles only of the pyramids and their passage before him, gave his decided opinion that they were "not connected with any astronomical fact, and probably adopted for agricultural reasons; and the knowledge of the above proportions will I think lead to the same conclusion: for with the most solid and enduring shape possible, the builders obtained a mathematical symmetry which no other proportions could give. Although this pyramid was nearly 480 feet in perpendicular height of solid masonry, the pressure of the solid mass is so distributed, that the lower courses have only to sustain about 25,000 lb.; therefore it is evident that the main objects of the architect—viz., stability and eternal duration—were well effected. The inclination of the entrance passage of the great pyramid was regulated by a proportion of 2 to 1: that is, two feet horizontal to one foot perpendicular.

"The same mode of regulating the angles is observable in every instance; thus where inclined blocks were used to cover an apartment, a certain portion of the width of the room was taken for the rise or pitch; as in the queen's chamber, where the rise is a third of the width of the apartment, and also the angle of the air passages leading from the king's chamber to the exterior, have a rise of one perpendicular to two horizontal. From finding in every case that the angles were thus regulated, I have come to the conclusion that the Egyptians, at the time of the erection of these mighty monuments, possessed no knowledge of the division of the circle into degrees, but that their angles were regulated by the proportion of base to perpendicular height; in fact, the tangential measure of the angle, and not its abstract measurement. That they learned to divide the circle into degrees at a later period is highly probable, as they were celebrated for their astronomical knowledge.

"In every part of the pyramids evidences of premeditated and careful design are apparent; but my present purpose is to draw attention to the more striking points in the general pyramid only. The situation of the apartments in the pyramid appear to have been regulated as follows—

Height from base (external) to floor of passage of queen's chamber	40 cubits
From the above to floor of king's chamber, or principal apartment	40 "
From the above to top of upper chamber	40 "
From the above to apex of pyramid	160 "
Total	280 cubits

Making 280 cubits in perpendicular height, as above stated. The floor

of the subterraneous apartment was also 60 cubits below the base of the pyramid."

THE THAMES TUNNEL.

This important undertaking was opened for foot passengers on the 25th of March last. Thus, after many years of anxiety and difficulty, perhaps without parallel in the history of great public works, the practicability of forming a thoroughfare for carriages and foot passengers under a deep navigable river, and without interruption to the navigation, is proved and executed. The obstacles, which have from time to time impeded, and all but stopped the progress of the tunnel, have been numerous. The work was commenced in 1825, but was stopped in 1828 by an irruption of the Thames. From that time to the spring of 1835 no progress was made. In this year, under the sanction of an Act of Parliament, the Treasury allowed the Exchequer Loan Commissioners to advance, out of the grant voted for public works, the money necessary to complete the tunnel; and it was again commenced and has been continued with but few inevitable interruptions and delays to the present time, when, as the directors have stated, it is securely completed, and is now thrown open to the public as a thoroughfare for foot passengers. The two roadways for carriages under the river are also perfectly completed. From its commencement to the present date there has been but 11 years within which the excavation could be carried on. And during this time, for nearly two years or ninety-nine weeks, the works were suspended from circumstances beyond the control of either the directors or the engineer. The work has been in fact executed in about 9 years of actual work, at a cost of about £446,000, including property and expenses of every kind, with the particulars of which the proprietors have been accurately and annually acquainted. The actual tunnel of 1200 feet was executed in eight years. The carriage-way descents are now alone wanting to complete the work. They are susceptible of being contracted for in the ordinary way.

☞ The editors of the Railroad Journal present their compliments to the *Officers, Engineers, and Superintendents* of Railroads, and request them to furnish for publication in its pages, any interesting or important fact which their experience may have established calculated to present the subject of railroads in its true light. Facts, *well established facts*, properly spread before this enlightened community are only necessary to ensure a gradual but *constant* extension and improvement of railroads in this country; and who can so readily furnish such facts as those constantly engaged in the construction and management of railroads? and what medium of publication so proper as the Railroad Journal? When important facts are furnished for *first* publication in the Journal, measures will be taken to give them extensive circulation through the newspaper press of the country, by sending *slips* to several hundred editors—and requesting its republication.

☞ Correspondents are requested to send in their communications early, as it is intended hereafter to issue the Journal and despatch it to subscribers, *before* the first of each month.

ERRATA—Page 161, tenth line from top, for "260 or thereabouts," read

240 *in number.* Same line, for "about eleven feet," read *ten* feet. Page 162, 14th line from top, for "of eleven feet," read of *ten* feet; 16th line from top, for "about eight feet," read *seven and a half feet.*

The March number of the Journal, which was passed over in order to come up with the train, will be issued and sent out with the number for July, and thus be again even with our cash subscribers, when —it cannot be doubted—others will make matters even with us for the past, and right for the future—in advance. Good fuel, and plenty of it, is essential to attain high velocities with the Locomotive—so also, is it important to the future success and improvement of this Journal, that arrearages should be liquidated, and none be allowed hereafter, to arise.

After a retirement of three years from all connection with its concerns, the undersigned again resumes his former station, in connection with his late associate, Mr. Geo. C. Schaeffer, as Editor and Publisher of the Railroad Journal, and Mechanics' Magazine. His retirement was from *necessity*, and a source of deep regret; his return is from *choice*, and, in the hope of contributing in some degree to make the Journal useful to the cause for which it has so long labored, highly gratifying to him.

The Journal, on its first appearance, January 1st, 1832, was cordially and generously greeted by the press throughout the country; and also by gentlemen connected with the *few* railroads then under construction; and, notwithstanding the oddity of its title, and the doubts of many as to the possibility of finding materials even to give a *tone* to its pages, much less to fill them, its course for several years was *onward;* but the *great fire* of December 1835, and the general depression of business for several years past, has borne heavily upon it. It has, however, been continued until the present period, from whence it is believed that we may look forward to more prosperous times: and to a gradual but *certain* extension and improvement of the railroad system; and it is now designed to make an effort to extend the circulation of the Railroad Journal, and increase its usefulness, by *reducing* the *price*, *stereotyping* its pages, and issuing it *punctually.*

To insure the success of the Journal under the new arrangement, a renewal of the courtesies of the *Press* and the friendly efforts of those interested in, or connected with, the works of internal improvement and the mechanic arts, throughout the country are respectfully solicited, and will be duly appreciated.

D. K. MINOR.

New York, May, 1843.

CONTENTS:

☞ This number contains one sheet of 32 pages. The postage is only one cent any distance within the State, or under one hundred miles, and one and a-half cents for over one hundred miles and out of the State.